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Modeling Returns Volatility for stocks issued by social responsible companies

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SUMMARY

Trading stocks has never been more accessible to investors like in the 21st century. Financial markets develop continuously and the values traded are higher and higher and the facilities investors get are multiple since their preferences have been made wider and wider. New trading ways and new financial instruments have been developed lately.

Some investors prefer to obtain not only financial benefits, but also ethic benefits in order to support social and environmental causes. That is why social responsibility is a factor that has led to the development of a new trend on the financial markets: social responsible investments. Social responsible investments are represented by stocks issued by social responsible companies.

From a trading perspective, the new technological innovations have impacted the financial markets in the latest 10 years. High frequency trading is seen as an innovating trading method and it has a very important role in transforming the financial markets by offering them dynamism and complexity.

High frequency trading is a preferred trading way for institutional investors. They have enough financial resources to afford buying expensive powerful systems and algorithms and they can afford to take big risks in order to have high expected returns.

High returns can be obtained thanks to the trading systems that facilitate a very quick trading; the returns are not high because of the big difference between bid and ask prices but because there are numerous trades made during a short time interval. But since returns are volatile, investors are interested to find out what would be the returns volatility on a short and very short term (during a day or during half an hour).

High frequency trading makes possible to record high frequency data. High frequency data are different and special when comparing them to low frequency data so new models are needed in order to analyze financial markets variables, in order to understand and to forecast them.

Having set-up this economical context, the title of this paper: "*Modeling returns volatility for stocks issued by social responsible companies*" was chosen to concentrate and to highlight the purpose of this research.

The purpose is to model the volatility returns of stocks issued by social responsible companies and to compare it with the volatility returns of stocks issued by social irresponsible companies (we consider the returns to be a time function, not dependent on any other variables). Even if other researchers have already made similar comparisons, there is no general accepted conclusion to state that there is one type of investments better than another. However, our purpose is to support and promote social responsible investments by showing that it is in the benefit of the investors that use high frequency trading to place their financial resources into stocks issued by social responsible companies. In this way they could obtain tangible benefits like financial returns and also ethical, intangible long term benefits. Two types of models have been chosen: *heteroskedastic ARCH models* and *realized volatility models.*

The purpose just mentioned is based on two primary hypotheses.

The first hypothesis is that *returns for stocks issued by social responsible companies are higher compared to returns for stocks issued by social irresponsible companies*. Being able to confirm this hypothesis would encourage investors who use high frequency trading to give a higher importance to social responsible investments because they will obtain not only intangible, but also tangible benefits.

The second hypothesis of the study is that *heteroskedastic models are not as performant as realized volatility models are*. More specifically, we would like to demonstrate that HARRV models (realized volatility models) have a higher performance compared to ARCH models (heteroskedastic models). Being able to do this, we could support econometricians that look for volatility models with a high performance.

To fulfill the purpose and to verify the 2 hypothesis of the study, we set 4 specific **objectives**:

The first objective is to describe, to measure and to estimate the returns and the returns volatility for stocks issued by social responsible companies and for stocks issued by social irresponsible companies. This objective is relevant to prove the first hypothesis of the study and to help investors to decide if corporate social responsibility is a criterion to be considered when investing on financial markets.

The second objective is related to parameter estimation for EGARCH, GARCH-M and HARRV models. It is relevant to study the persistence and the asymmetry of the volatility. If the volatility is persistent, the forecasting process can be done more easily. If the volatility is asymmetric, the informational shocks on the financial markets have a different impact over the returns volatility.

The third objective is to compare heteroskedastic EGARCH and GARCH-M models with HARRV and, based on the biggest adjusted R squared, we will identify the models with the best performance. The results are relevant for the statisticians who use high frequency data sets because they will have one more proof (beside the ones already in the literature) of the fact that there are models which better fit high frequency data sets.

The forth objective is to forecast the volatility on a short term. If the reality matches the results obtained through

the forecasting process, then we can prove that the utilized models represent a useful instrument which can help investors in their decision process.

The structure of the paper facilitates the reader to understand the concepts, the methods and the results in it.

Hence, the introduction of the thesis if followed by a literature review and then by the **Chapter I** where there are described the concepts of the research in order to give to the reader the big picture over the research. Concepts like corporate social responsibility, high frequency trading, high frequency data analysis are treated from a critic practical and academicals perspectives.

Before deciding what the destination of their financial resources is, investors must evaluate an investment opportunity. Two evaluation elements are returns and volatility returns. **Chapter II** includes research methodology related to *returns* and *returns volatility*. Moreover, we measured the returns and we estimated the returns volatility and we compared them in order to confirm or to deny the first hypothesis of this study.

Chapter III highlights the importance of the volatility models for investors and states different ways to model it. Also, this chapter includes the research methodology related to heteroskedastic models.

Chapter IV includes the research methodology related to realized volatility models. There are researchers that already proved the fact that realized volatility models perfom better than heteroskedastic models when high frequency data are used. Moreover, different authors proved that realized volatility models have a better performance to forecast the volatility.

In the end, the conclusions highlight the utility of the results for the investors; we also mentioned some personal contributions, some limits and some further research directions.

The personal contributions can be summarized as it follows:

1. Practical aspects are combined with theoretical elements in order to offer a complete picture over the topics included in the thesis.
2. To increase the statistical significance of the results, a considerable number of companies have been included in the study: 64 companies.
3. In order to improve the estimation and forecast process of returns volatility, the current study considers a sample based on high frequency data
4. We add evidence to the literature about the relationship between the stock returns and the presence of social responsible principles.
5. We add evidence to the literature about the relationship between stock returns and stock returns volatility (the relationship has been studies through GARCH-M models).
6. For EGARCH and GARCH-M parameter estimation, we compared the results provided by EViews with the results provided by R and we concluded the fact that there are no material differences, so R provides accurate results, even if the packages have been recently developed.
7. We proposed a new concept in Romanian language, concept translated from the English concept of "realized volatility".
8. In order to identify the models with the best performance when high frequency data are used, we compared heteroskedastic models with realized volatility models and we add evidence to the literature concluding that realized volatility models perform better than heteroskedastic models.
9. We applied HARRV models, recently developed and proposed.
10. The mathematical form of the HARRV equation is a result of a personal summary of the equations found in the literature.

The topic of this research has been chosen to bring into the attention of the investors that corporate social responsibility can have an impact over the returns they obtain when they trade using a high frequency trading approach. Of course, returns are related to their volatility.

The economic utility has been obtained together with the results of the research and their interpretation.

The purpose of the paper (*to model the volatility returns of stocks issued by social responsible companies and to compare it with the volatility returns of stocks issued by social irresponsible companies*) has been fulfilled together with the **4 objectives** that have been met.

The first objective (*to describe, to measure and to estimate the returns and the returns volatility for stocks issued by social responsible companies and for stocks issued by social irresponsible companies*) has been met in Chapter II and led us to deny the first hypothesis of the study. The returns have been measured using log returns and the returns volatility has been estimated using daily squared returns, absolute daily returns and realized volatility.

The second objective (*related to parameter estimation for EGARCH, GARCH-M and HARRV models*) has been met in Chapter III and Chapter IV and enabled us to study the asymmetry and the persistence of volatility and to identify the relationship between returns and returns volatility (even if the relationship was not statistically significant). The volatility is persistent and it is really helpful in forecasting the volatility. The volatility is also asymmetric meaning that negative information has a bigger impact on volatility compared to positive information.

The third objective (*to compare heteroskedastic EGARCH and GARCH-M models with HARRV and, based on the biggest adjusted R squared, we will identify the models with the best performance*) has been met in Chapter IV and allowed us to confirm the second hypothesis meaning that a category of volatility models has a better performance compared to the other category.

The forth objective *(to forecast the volatility on a short term)* has been met in Chapter IV. Considering the obtained results, we can say that HARRV models are very useful tools in forecasting volatility process; the econometricians can use them and the institutional investors who adopt high frequency trading can find out information about the future volatility and can be supported during the process of taking investment decisions.

The first hypothesis of the study (*returns for stocks issued by social responsible companies are higher compared to returns for stocks issued by social irresponsible companies)* was not confirmed within Chapter II. In spite of the personal expectations, returns for stocks issued by social responsible companies are 144% lower compared to stocks issued by social irresponsible companies. Therefore, we are unable to support and promote social responsible investments; investors will be interested not only to get social benefits but also financial benefits when trading stocks. However, other factors must be considered before deciding the destination of their financial resources: returns volatility is one of these factors.

Returns volatility for stocks issued by social responsible companies is lower compared to returns volatility for stocks issued by social irresponsible companies. Hence, an investor with risk aversion behavior will prefer lower returns volatility, even if the returns will be also lower and they will choose to invest and trade stocks issued by responsible companies which are not dramatically impacted by negative information shocks because of their good and stable

reputation. In the same way we can conclude that an investor who prefers the risk will choose stocks issued by social irresponsible companies because they will have higher chances to get higher returns even if the returns volatility will also be higher and they will not be worried about the reputation of these companies.

The second hypothesis of the study (*heteroskedastic models are not as performant as realized volatility models are)* has been confirmed. Heteroskedastic models have a higher performance only in 2.86% cases. HARRV models have a higher performance for all the other cases, 97.14%. This means that high frequency data are not compatible with heteroskedastic models (their performance is week) but realized volatility models are more appropriate to be used.

We are aware of the fact the current research is limited so we would like to state some **limits of the research**:
- Stock prices are not adjusted accordingly to the event that had an impact over the financial markets during the sample period;
- The sample period is not long enough to determine what the impact of realized volatility aggregated on a monthly basis is;
- The "highfrequency" package from R is not sufficiently developed in order to enable us to estimate HEAVY model parameters.

However, these limits can determine us to extend the research, so we mention here some **further research directions**:
1. An event analysis would be conducted in order to see if the returns volatility is impacted by different market events (like disclosing the financial results of a quarter);
2. A comparison between the returns volatility calculated on short time intervals (5 minutes) and daily time intervals can be done in order to see if is more benefic to invest using a high frequency trading approach or a traditional trading approach.

3. HEAVY model parameters would be estimated as soon as "highfrequency" package from R would allow us to do so. This would enable us to compare HEAVY model with HARRV, EGARCH and GARCH-M models and to determine which one better fits the considered data sets.